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A NEW *GILIA* (POLEMONIACEAE) FROM LIMESTONE OUTCROPS IN THE SOUTHERN SIERRA NEVADA OF CALIFORNIA

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ABSTRACT

Gilia yorkii, a new species discovered in the southern Sierra Nevada, is restricted to limestone outcrops. From its morphology *G. yorkii* is identified as a member of *Gilia* sect. *Saltugilia,* and within the section it appears most like *G. scopulorum* M. E. Jones, a desert species. The two species differ in several characters, including different corolla proportions and some contrasting trichome details.

From recent explorations on xeric limestones (marbles) in the southern Sierra Nevada a new species of *Gilia* has been discovered. *Gilia yorkii* is scattered primarily over the southern exposures of a large north-south trending limestone ridge. At its highest point, this sheer-walled limestone formation rises more than 1000 m above the South Fork of Kings River. It occurs just east of Horseshoe Bend along both sides of the river canyon. This interesting new species was discovered by Dana York on 31 July 1995 in Monarch Wilderness, while exploring the steep and rugged limestone terrain.

Gilia yorkii Shevock & A. G. Day, sp. nov. (Fig. 1)—TYPE: USA, CA, Fresno Co, 86 km E of Fresno, Sequoia National Forest, Monarch Wilderness, 1 km S of Boyden Cave on S side of Kings River Canyon, 36°48′20″N, 118°48′40″W; T13S, R29E, S10, NW ¼ of SW ¼, 1290 m. 27 June 1996, *York & Shevock 949* (holotype CAS; isotypes JEPS, FSC).

Herba annua inter species sect. *Saltugilia* V. Grant & A. D. Grant trichomatibus a foliis multiseptatis et translucidis, calyce glanduloso, corollae lobulis lavandulis, capsula late ovoidea, inclusa, et seminibus in loculis 2–3, ad *G. scopulorum* M. E. Jones accedens sed differt foliis basalibus paucis, foliis paucilobis, vel interdum foliis integris, trichomatibus curvus, eglandulosis (nec patentibus nec glandulosis), trichomatibus pedicello et calyce glandulosis minutus incoloribus (nec magnus nec nigris), corolla minor, tubo incluso (nec exserto nec exserto longissimo).

Annual herb 10–25 cm high, with one or two somewhat spreading branches arising near base of main stem, sometimes vigorous plants becoming diffusely branched and to 4 dm high. Stems pubescent below middle or near base, with multiseptate, translucent, eglandular trichomes; upper stems densely glandular-puberulent. Basal and lower cauline leaves 2–8, with basal mostly drying and falling early, thus only vigorous, immature plants with unexpanded internodes show a definite basal rosette. Lower leaves pubescent on ventral side, densely so in their axils, trichomes very fine, multiseptate, eglandular, broad at base, fine-tapered near tip, shining, translucent, often ± bent at septa (Fig. 1D). Basal and lower cauline leaves 1.5–2.5 cm long, 1-pinnate or entire, oblanceolate, rachis linear below, broadened between lobes, lobes 5–7 in ascending, subopposite pairs, 3–5(7) mm long, elliptic, acute, entire or with 1–2 teeth near apex. Upper cauline leaves glandular-puberulent, elliptic, generally with two narrow, spreading, basal lobes, uppermost leaves reduced, entire. Upper stems, pedicels and calyces densely glandular-puberulent, trichomes stipitate, glands minute, (0.05 mm diam.), colorless, stipe narrower than gland, ca. twice as long as diameter of gland. Inflorescence loose, cymose, pedicels 3–10 mm in flower, in subequal to unequal pairs, or in 3's, elongating and divergent spreading in fruit to 5–33 mm. Calyx 3–3.6 mm long in flower, accrescent, ribs, lobes and membrane glandular-puberulent or rarely in earliest flowers calyx trichomes longer, non-glandular, as on lower leaves, ribs 0.2 mm wide, green, or in age red-streaked, connected by sinus membrane in lower half, membrane at maturity splitting between ribs to near base. Corolla 7–8.5 mm long, tube and throat together ±4 mm long, included in calyx, or upper throat exserted, tube and lower throat white, sometimes lavender-tinged, upper throat and lobes lavender to white; lobes spreading, 3–5 mm long, 2.5–4 mm wide, elliptical to broadly elliptical, apex rounded. Stamens inserted equally 0.5 mm below sinuses, filaments 0.2–1 mm long, anthers 0.9–1.5 mm long, maturing in or slightly above orifice, pollen blue. Style exserted beyond anthers, stigmas 1–1.5 mm long, spreading, tips curling downward toward, or touching anthers. Capsule broadly ovoid, 3–4.5 mm long, 1.4–1.7× as long as wide, equal to, or slightly exceeded by calyx, dehiscing by

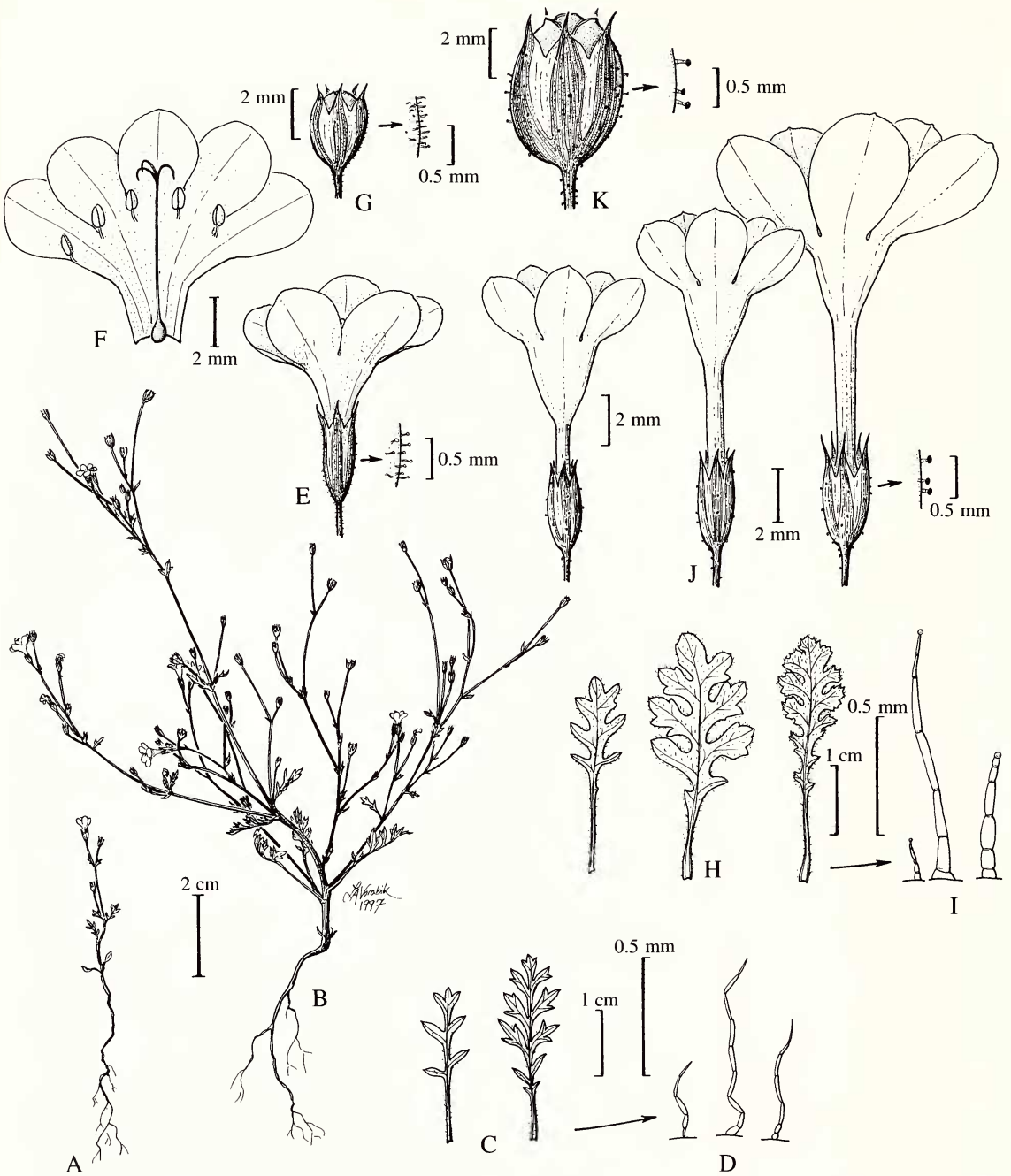

FIG. 1. Habit of *Gilia yorkii* Shevock & A. G. Day, with details shown in comparison with *G. scopulorum* M. E. Jones. A–G. *Gilia yorkii,* from holotype collection: A–B. Plant habit; A. young plant in early flower, with cotyledons present; B. Mature plant in flower and fruit; C. Basal and lower cauline leaves; D. leaf trichomes; E. *Flower with detail of calyx trichomes; F. Dissected corolla with stamens and style; G. Calyx with mature, included capsule. H–K. *G. scopulorum:* H. Variation in basal leaves, (l to r) *Darrow s.n.* (CAS 336894), *Prigge 994* (CAS 615000), *Raven 11790* (CAS 517748); I. leaf trichomes; J. *Flowers from three different collections, showing variation in corolla, and detail of calyx trichomes, (l to r) *Pinzl 2611* (CAS 637910), *Raven 11790* (CAS 517748), *Prigge et al. 769* (CAS 606023); K. Calyx with mature, included capsule, *Prigge 994* (CAS 615000).

Note: Corolla lobes are shown erect for comparisons of size and form. In real life, as in other Gilias, the lobes are spreading. This is shown in views of two flowers in the habit drawing of *G. yorkii* (B).

splitting between valves from apex to near base. Seeds 0.8–1.5 mm long, brown, verrucate, ± oblong, 2–3 per locule, mucilaginous when wet. Pollen grains ± spheroidal, zonocolporate, colpi 7–8, exine striate.

Paratypes. USA, CA, Fresno Co., Monarch Wilderness, vicinity of Boyden Cave, 31 Jul 1995, *York & Shevock 107* [CAS]; 31 Jul 1995, *York & Shevock 112* [CAS, FSC, JEPS]; 13 Oct 1995, *York 207* [CAS].

Distribution, Habitat and Phenology

Gilia yorkii is known only from the southern Sierra Nevada in Fresno Co., California, from limestone outcrops in the vicinity of Boyden Cave in the Kings River Canyon. Plants grow in fissures, ledges, and terraces in sandy or gravelly soils developed from weathered limestone, at elevations from 1290 to 1830 m. Within its habitat *G. yorkii* can easily be overlooked because the pale lavender flowers blend in with the surrounding limestone. Plant size may vary widely, depending on the timing and amount of late spring to early summer rain. In a year with early as well as late rains, plants may become tall and spreading, diffusely branched and abundantly flowered. In a more normal year, however, plants are apt to be smaller at maturity and to have fewer flowers.

The exposed limestone habitat occupied by *G. yorkii* is very arid, and during summer plants are subjected to daily ambient temperatures in excess of 34°C. The time of anthesis, depending upon the particular seasonal conditions, appears to range from May to July.

While the number of *G. yorkii* plants has not been estimated, the population could number in the thousands under optimum conditions. Only a portion of the potential habitat has been surveyed because of the rugged nature of the area.

This habitat is dominated by many petrophilous taxa along with species generally located within chaparral and foothill woodland plant communities. Prominent among these are woody associates including three *Cercocarpus* species: *C. intricatus* S. Watson, *C. betuloides* Torrey & A. Gray, and *C. ledifolius* Nutt. var. *intermontanus* N. Holmgren; and also *Garrya flavescens* S. Watson, *Pinus monophylla* Torrey & Frémont, *Rhamnus tomentella* Benth., *Umbellularia californica* (Hook. & Arn.) Nutt., and *Yucca whipplei* Torrey.

Other common associates, including annuals, ferns, and other perennial herbs are the following: *Argyrochosma jonesii* (Maxon) M. D. Windham, *Asclepias fascicularis* Decne., *Astragalus congdonii* S. Watson, *Avena sativa* L., *Bromus madritensis* L. ssp. *rubens* (L.) Husnot, *Cheilanthes cooperae* D. Eaton, *Cirsium occidentale* (Nutt.) Jepson var. *californicum* (A. Gray) Keil & C. Turner, *Clarkia rhomboidea* Douglas, *Eriogonum nudum* Benth. (*sensu lato*), *Erysimum capitatum* (Douglas) E. Greene, *Heterotheca monarchensis* York, Shevock & Semple, *Heuchera rubescens* Torrey var. *alpicola* Jepson, *Mentzelia laevicaulis* (Hook.) Torrey & A. Gray, *Mimulus floribundus* Lindley, *Nemacladus interior* (Munz) G. Robb., *Petrophyton caespitosum* (Nutt.) Rydb. ssp. *acuminatum* (Rydb.) Munz, *Selaginella asprella* Maxon, *S. hansenii* Hieron., and *Streptanthus fenestratus* (E. Greene) J. Howell.

The general aspect of the vegetation is markedly different at the borders of the limestone habitat, where reddish metamorphic rock outcrops support canyon live oak woodland with scattered *Torreya californica* Torrey and chaparral elements, but not *Gilia yorkii.*

Relationships

From its morphology *Gilia yorkii* fits readily into *Gilia* sect. *Saltugilia,* and within the section it appears rather like *G. scopulorum* M. E. Jones, sharing characters concerning pubescence, seed-number, and capsule form. They have a similar leaf type, as seen in the venation pattern, with the lobes, and their veins ascending. The lobes are toothed on both sides (Fig. 1C, H), but the leaves of *G. yorkii* are smaller, more delicate, and with lobes sparingly toothed. The two species also show some similarity in habitat, both commonly occurring in limestone areas. However, *Gilia scopulorum* has also been found on volcanic substrates.

In the Jepson Manual key to *Gilia* (Day 1993) *G. yorkii* would fall near the *G. scopulorum* position. A segment of that key, shown below, has some added details, and a new dichotomy to include *G. yorkii.* The important differences between *G. yorkii* and *G. scopulorum* are illustrated in Figure 1.

Gilia scopulorum leaf lobes tend to be large, and many-toothed, but sometimes are ± reduced, as in *G. yorkii,* entire or with 1–2 teeth. A stout, erect, leading stem above a well-developed rosette of basal leaves is the usual condition in *G. scopulorum.* However, this is not found in mature plants of *G. yorkii,* which lack a definite basal rosette of leaves, and have a shorter, generally several-branched central stem.

Other important differences are the shorter, included corolla tube of *G. yorkii* (Fig. 1E), and differences in size and gland-type of trichomes borne on the calyx and lower leaves and stems of the two species (Fig. 1E, J).

The importance of trichomes in differentiating species and larger taxonomic units of Polemoniaceae has been well demonstrated, as in *Gilia* sect. *Arachnion,* named for a characteristic trichome type, making up a fine arachnoid pubescence of all the member species (Grant and Grant 1956), and which is not found elsewhere in the genus.

Within sect. *Saltugilia* all species have multiseptate trichomes on the lower leaves, but as the key indicates, they are not all alike. Usually the multiseptate trichomes are coarsely translucent, often ± glandular, and straight or variously curving; but in

G. stellata A. A. Heller they are opaque-white, eglandular and markedly geniculate. In *G. yorkii* the multiseptate trichomes (Fig. 1D) have yet another variation: although translucent, they are very fine, eglandular, and often bent at the septa, or curving, but not markedly geniculate as in *G. stellata.*

The densely glandular-puberulent calyx of *G. yorkii* is unique in the section. The calyx in other species is either glabrous (*G. splendens* H. Mason & A. D. Grant group) or coarsely glandular-dotted (*G. scopulorum* and *G. stellata*). The scattered, large black glands on the calyx of *G. scopulorum* (Fig. 1J) contrast with the closely-spaced, minute, colorless calyx glands in *G. yorkii* (Fig. 1E).

Corolla proportions are variable in *G. scopulorum* (Fig. 1J). Usually the corolla tube is long-exserted; but a variant with a short, slightly-exserted corolla tube was collected several times in Mohave Co., Arizona and in south-western Nevada (Fig. 1J, flower no. 1). This approaches the form of the *G. yorkii* corolla, but the tube is exserted. In *G. yorkii* the tube, as well as the throat, or part of it, are included in the calyx (Fig. 1E). In all significant characters the above variant of *G. scopulorum* differs from *G. yorkii.*

Key to *Gila* Sect. *Saltugilia,* (in part) (Modified from The Jepson Manual, Key to *Gilia* (Day 1993))

1. Calyx glabrous; capsule narrowly ovoid, exceeding calyx; capsule valves 2–3× longer than wide; seeds 7–23 per locule. . . . . *G. splendens, G. australis* and *G. caruifolia.* (For key to this species group see Day, 1993: 830.)

1′ Calyx glandular-dotted; capsule broadly ovoid, included in calyx, capsule valves <2× longer than wide; seeds 2–6 per locule.

5. Trichomes on lower leaves opaque-white, eglandular, geniculate; corolla throat with purple spot below each lobe; seeds 3–6 per locule . . . *G. stellata*

5′ Trichomes on lower leaves translucent, straight or ± curved, glandular or eglandular; corolla throat not spotted; seeds 2–3 per locule.

6. Corolla 7–8.5 mm long, tube and throat (or part of throat) included in calyx; calyx and pedicels densely glandular-puberulent, glands minute, colorless; trichomes on lower leaves and stems few, scattered, denser in leaf axils, very fine, eglandular, variously curving. Rare endemic. Sierra Nevada, CA., Kings River Canyon . . *G. yorkii*

6′ Corolla 9–17 mm long, tube exserted, generally 2× calyx or longer; calyx and pedicels glandular-dotted, glands large, black; trichomes on lower leaves and stems dense, coarse, gland-tipped, ± straight, spreading. Desert mountains E of Sierra Nevada, CA to AZ, UT . . . . . *G. scopulorum*

Discussion

Gilia yorkii and *G. scopulorum* are allopatric, being geographically isolated. *Gilia scopulorum* occurs in desert mountains of the Great Basin, Mojave, and Sonoran deserts from Utah and Arizona to California, but it does not extend to the Sierra Nevada. *Gilia yorkii* occurs only in the southern Sierra Nevada, west of the summit divide. However, this particular Sierran habitat is arid and desert-like, which is also indicated by the dominant species, and is quite unlike surrounding areas in the Kings River Canyon.

The two species show relationship in the numerous morphological characters that they share, but their recognition as distinct species is justified by their differences with respect to a number of other characters: trichome types, corolla proportions, plant habit, etc., and because no intermediates between them have been found.

Rarity

Gilia yorkii, previously unknown and uncollected, is an extremely rare species due to its lithophytic nature on limestones, a relatively uncommon substrate in the southern Sierra Nevada. While additional occurrences may well be discovered in steep canyons and rocky slopes, expansion of the distribution is unlikely to extend beyond the existing limestone outcrops in the Kings River basin. This species, therefore, is expected to remain a rare and localized endemic worthy of conservation efforts. Fortunately this new species, limited to its limestone habitat, is located within the Monarch Wilderness in very steep and rugged terrain. For these reasons anthropogenic impacts are likely to be few.

It is a pleasure to name this species for a colleague and friend who is actively exploring the Kings River Basin for the purpose of developing a floristic treatment for the region. His field work has already led to the discovery of three additional new taxa: *Heterotheca monarchensis* York, Shevock and Semple, and two as yet unnamed species of *Carex* and *Eriogonum.*

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